CLAIMS:

1.   A digital controller for producing a control pulse
signal with a variable frequency and a duty cycle dependent
upon a first digital value representing a first variable,
5   comprising:
          a digital circuit responsive to the first digital
value for producing second and third digital values
representing an on-time of a pulse and an off-time between
pulses of the control pulse signal; and
10   a timing and control unit responsive to the second
and third digital values to produce the control pulse signal
with pulses dependent upon said on-time and off-time;
          wherein the second and third digital values are
produced so that a sum of the on-time and the off-time varies,
15   depending on the first digital value, within a predetermined
range including a predetermined nominal period of the control
pulse signal.

2.   A digital controller as claimed in claim 1 wherein
the predetermined range is about two-thirds to about four-
20   thirds of the predetermined nominal period.

3.   A digital controller as claimed in claim 1 wherein
the digital circuit comprises a look-up table in which the
second and third digital values are stored for respective first
digital values.

25   4.   A digital controller as claimed in claim 3 wherein
the second and third digital values are represented using a
first and a second number of bits, respectively, in a first
part of the table and are represented using a third and a
fourth number of bits, respectively, in a second part of the
30   table, the third and fourth numbers being different from the

first and second numbers, respectively, and having a sum equal to a sum of the first and second numbers.

5.   A digital controller as claimed in claim 4 wherein the table is also arranged to store a pointer to a transition between the first and second parts of the table.

6.   A digital controller as claimed in claim 1 and comprising a further digital circuit responsive to a further digital value representing a second variable for modifying the first digital value in dependence upon the further digital value.

7.   A digital controller as claimed in claim 6 wherein the further digital circuit comprises:

a digital circuit responsive to the further digital value for producing a digital multiplier value in dependence upon a difference between the second variable and a reference value;

a multiplier for multiplying the first digital value by the digital multiplier value to produce a digital correction value; and

an adder for adding the digital correction value to the first digital value to produce a modified first digital value.

8.   In combination, a DC converter, a digital controller as claimed in claim 1, and an A-D (analog-to-digital) converter for producing the first digital value in dependence upon an input voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.

9.   In combination, a DC converter, a digital controller as claimed in claim 7, an A-D (analog-to-digital) converter for producing the first digital value in dependence upon an input voltage of the DC converter, and an A-D converter for producing the further digital value in dependence upon an output voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.

10.   A digital controller for producing a control pulse signal for a switch of a DC converter for varying a duty cycle and a switching frequency of the DC converter in dependence upon an input voltage for the DC converter, the digital controller comprising:

        an A-D (analog-to-digital) converter for producing a first digital value in dependence upon said input voltage;

        a timing and control unit for producing the control pulse signal with pulse on- and off-times determined in dependence upon second and third digital values; and

        a look-up table in which the second and third digital values are stored for respective first digital values, the look-up table being responsive to the first digital value to provide respective stored second and third digital values to the timing and control unit;

        wherein the stored second and third digital values are such that a sum of the on- and off-times varies, depending on the first digital value, over a predetermined range which includes a predetermined nominal period of the control pulse signal.

11.   A digital controller as claimed in claim 10 wherein the predetermined range is about two-thirds to about four-thirds of the predetermined nominal period.

12.   A digital controller as claimed in claim 10 wherein the second and third digital values are stored using a first and a second number of bits, respectively, in a first part of the table and using a third and a fourth number of bits,

5   respectively, in a second part of the table, the third and fourth numbers being different from the first and second numbers, respectively, and having a sum equal to a sum of the first and second numbers.

13.   A digital controller as claimed in claim 12 wherein

10 the table is also arranged to store a pointer to a transition between the first and second parts of the table.

14.   A digital controller as claimed in claim 10 and comprising an A-D converter for producing a further digital value in dependence upon an output voltage of the DC converter,

15 and a further digital circuit responsive to the further digital value for modifying the first digital value in dependence upon the further digital value.

15.   A digital controller as claimed in claim 14 wherein the further digital circuit comprises:

20   a digital circuit responsive to the further digital value for producing a digital multiplier value in dependence upon a difference between the output voltage of the DC converter and a reference value;

a multiplier for multiplying the first digital value

25 by the digital multiplier value to produce a digital correction value; and

an adder for adding the digital correction value to the first digital value to produce a modified first digital value for addressing the look-up table.

16.   A digital controller for producing a control pulse signal, comprising:

a look-up table for storing, and for providing in response to a first digital value in dependence upon which the look-up table is addressed, respective second and third digital values representing an on-time of a pulse and an off-time between pulses of the control pulse signal; and

a timing and control unit responsive to the second and third digital values to produce the control pulse signal with pulses determined by said on-time and off-time;

wherein the second and third digital values stored in the look-up table are such that:

for providing the control pulse signal with a small duty cycle the second digital value representing the on-time is small compared with the third digital value;

for providing the control pulse signal with an increased duty cycle the second digital value is unchanged and the third digital value is decreased whereby a frequency of the control pulse signal is increased;

for providing the control pulse signal with a further increased duty cycle the second digital value is increased and the third digital value is increased whereby the frequency of the control pulse signal is decreased;

and for providing the control pulse signal with a yet further increased duty cycle the second digital value is again unchanged and the third digital value is decreased whereby the frequency of the control pulse signal is increased.

17.   A digital controller as claimed in claim 16 wherein the second and third digital values are such that the frequency of the control pulse signal varies over a range of up to about 2:1.

18.   A digital controller as claimed in claim 16 wherein the second and third digital values are stored using a first and a second number of bits, respectively, in a first part of the look-up table and using a third and a fourth number of

5   bits, respectively, in a second part of the look-up table, the third and fourth numbers being different from the first and second numbers, respectively, and having a sum equal to a sum of the first and second numbers.

19.   A digital controller as claimed in claim 18 wherein

10   the look-up table is also arranged to store a pointer to a transition between the first and second parts of the table.

20.   A digital controller as claimed in claim 16 and comprising a further digital circuit responsive to a further digital value for modifying the first digital value for

15   addressing the look-up table in dependence upon the further digital value.

21.   A digital controller as claimed in claim 20 wherein the further digital circuit comprises:
        a digital circuit responsive to the further digital

20   value for producing a digital multiplier value in dependence upon a difference between the second variable and a reference value;
        a multiplier for multiplying the first digital value by the digital multiplier value to produce a digital correction

25   value; and
        an adder for adding the digital correction value to the first digital value to produce a modified first digital value for addressing the look-up table.

22.   In combination, a DC converter, a digital controller

30   as claimed in claim 16, and an A-D (analog-to-digital)

converter for producing the first digital value in dependence upon an input voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.

5   23.   In combination, a DC converter, a digital controller as claimed in claim 21, an A-D (analog-to-digital) converter for producing the first digital value in dependence upon an input voltage of the DC converter, and an A-D converter for producing the further digital value in dependence upon an
10 output voltage of the DC converter, wherein the DC converter comprises at least one switch controlled by the control pulse signal.